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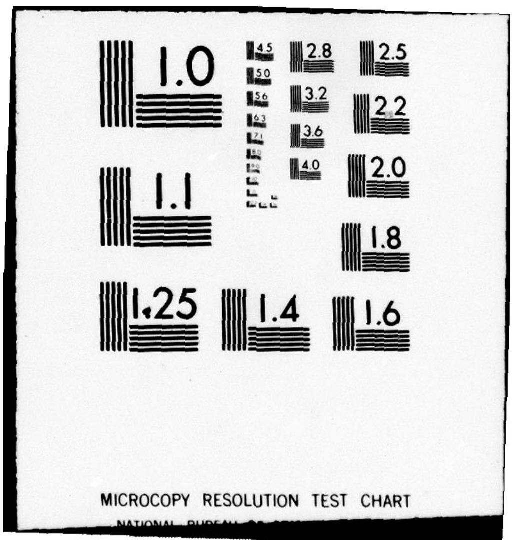
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6 EXPECTANCY THEORY AND POLICY CAPTURING:
A PREDICTIVE MODEL OF STUDENT EFFORT
IN AN ACADEMIC ENVIRONMENT.

THESIS

10 Merl A./Morehouse
Captain USAF

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of classmates, and a feeling of personal satisfaction, captured the valence policy. These same factors, plus the expectancy variable, captured the effort policy.

The data were supportive of both the valence and effort models; i.e. - the ability of the models to explain variation in the data, and the interactive nature of the differing components, were both substantiated. For the valence model, the mean R^2 was .8243, which attests to not only the internal reliability of the instrument, but also to the consistency of the model. For this sample, the data yielded a dichotomous version of expectancy (values 0 and 1). When the effort model was examined under this modification, the students incorporated expectancy information in their decision making.

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EXPECTANCY THEORY AND POLICY CAPTURING: A PREDICTIVE MODEL OF STUDENT EFFORT IN AN ACADEMIC ENVIRONMENT

THESIS

Presented to the Faculty of the School of Engineering
of the Air Force Institute of Technology
Air University (ATC)
in Partial Fulfullment of the
Requirements for the Degree of
Master of Science

by

Merl A. Morehouse
Captain USAF

Graduate Systems Management

September 1979

Approved for public release; distribution unlimited.

PREFACE

This thesis was written as part of the curriculum requirements for a Master of Science Degree in Systems Management, Air Force Institute of Technology, Wright-Patterson AFB, Ohio.

I would like to thank Dr. Michael J. Stahl for providing me the opportunity to perform this research and for supplying the guidance and assistance necessary to see it through to completion.

I would also like to express my appreciation to Dr. Adrian Harrell for assistance in designing the policy instrument and for his humor, and to Dr. Charles W. McNichols for assistance in dealing with computer progamming.

My sincerest thanks goes to my family. They not only gave me the needed support, but also provided the distraction which maintained my perspective.

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ABSTRACT

This thesis examined the valence and force models as hypothesized by Vroom's expectancy theory. It also examined the behavioral characteristics of the variable expectancy.

The research involved a decision making exercise to capture the course preference and behavioral choice (effort) policies of 50 Air Force Institute of Technology graduate students. Three course factors, Grade Point Average, regard of classmates, and a feeling of personal satisfaction, captured the valence policy. These same factors, plus the expectancy variable, captured the effort policy.

The data were supportive of both the valence and effort models; i.e. - the ability of the models to explain variation in the data, and the interactive nature of the differing components, were both substantiated. For the valence model the mean R^2 was .8243, which attests to not only the internal reliability of the instrument, but also to the consistency of the model. For this sample the data yielded a dichotomous version of expectancy (values 0 and 1). When the effort model was examined under this modification, the students incorporated expectancy information in their decision making.

EXPECTANCY THEORY AND POLICY CAPTURING: A PREDICTIVE MODEL OF STUDENT EFFORT IN AN ACADEMIC ENVIRONMENT

I. Introduction

In the early 1800's, the people of the United States were becoming more footloose and were abandoning the traditional family trades. The resulting loss of skilled workers led Eli Whitney to construct an assembly line with standard, interchangeable parts. What made this assembly process unique was not the use of standard parts, but the use of completely unskilled labor. Whitney had, in fact, introduced division of labor-- a new system which marked the turning point between handicrafts and industry (Cooke, 1973). This concept revolutionized the concept of human labor.

The beginning of the 20th century brought with it the Industrial Revolution, and with it came more than just child labor and the centralized workplace. Organizational behavior arose as a topic of interest, and researchers of the time became involved with the study of both the worker and the workplace.

The earlier studies focused primarily on organizational improvement; measure the worker's aptitude and attitude and place him in a position that benefits both him and the organization. There was interest in behavior, but interest

only in how to channel it toward some beneficial end.

Through the early and mid 1900's, researchers began to examine motivation with greater emphasis. Specifically, in 1964, Victor H. Vroom authored a book entitled Work and Motivation. The predominant intention of that work was to present what Vroom referred to as a "cognitive model of behavior"; individuals choose among alternative courses of action due to "psychological events occuring contemporaneously with the behavior" (Vroom, 1964, p. 14). For the first time, someone had presented a complete model of behavior which could possibly be used to predict what individuals would do under a given set of circumstances.

A Cognitive Model of Behavior (Vroom, 1964)

Prior to examining the conceptual model, it is necessary to understand the underlying basis that represented the departure point for Vroom. The concept of hedonism and the belief that behavior is normally ahistorical in nature constitute the primary substance of that basis.

Hedonism, or hedonistic behavior, implies action directed toward the achievement of pleasure (or pleasureable things), and away from pain. Given a little logical thought, the rationale behind the idea of hedonism is obvious, and requires no further explanation here. The ahistorical approach views behavior as dependent only upon circumstances existing at the time, not upon events that have gone before; the only effect of history is to

modify conditions which exist in the present. Vroom's model, then, is based on the viewpoint that an individual's choices in any given situation are "explained in terms of his motives and cognitions at the time he makes the choice" (p. 15).

The Concept of Valence

An assumption made by Vroom in the formulation of his model was one of individual preference. Given two outcomes, x and y, a person will prefer x to y, y to x, or be indifferent between them. Within related literature, this preference is given many names, but the term used throughout Vroom's book and throughout this work is valence.

Valence can take on a wide range of values, both positive and negative. If an individual prefers the attainment of some outcome, then that outcome is positively valent. The outcome has zero valence if the person is indifferent to attaining it, and negative valence if the person prefers not attaining the outcome to attaining it. Of importance is the distinction between valence and value. At any given point in time, there may be a great difference between anticipated satisfaction from an outcome (valence) and the satisfaction the outcome actually provides (value).

What Vroom was suggesting was that "means acquire valence as a consequence of their expected relationships to ends" (p. 16). As support for his theory, Vroom cited Peak (1955), who proposed two determinants of attitude:

(1) the cognized instrumentality of the object of the attitude for the attainment of various consequences, and (2) the intensity and the nature of the affect expected from these consequences. Research which supported Peak's proposal (Rosenberg, 1956; Carlson, 1956; Peak, 1960) led Vroom to make the following proposition about the valence of outcomes and their expected consequences:

> Proposition 1. The valence of an outcome to a person is a monotonically increasing function of the algebraic sum of the products of the valences of all other outcomes and his conception of its instrumentality for the attainment of these other outcomes.
>
> In equation form, the proposition reads:
>
> $$V_j = f_j \sum_{k=1}^{n} (V_k I_{jk}) \qquad (j=1, \ldots, n)$$
>
> where V_j = the valence of outcome j
>
> I_{jk} = the cognized instrumentality of the outcome j for the attainment of outcome k
>
> (Vroom, 1964, p. 17)

The Concept of Instrumentality

Found within the forerunning explanation and statement of Proposition 1 is the term "instrumentality". Although not stated as a separate proposition, the explanation of this term is indeed a concept within itself.

To an individual, an outcome may be either positively or negatively valent. The outcome may acquire the valence, not for its particular intrinsic properties, but for the

anticipated satisfaction or dissatisfaction to which it is expected to lead.

As an illustrative example, consider the individual who works at a task he finds dissatisfying. He knows, however, that through job performance, he can earn enough money to acquire those things which are believed to be satisfying to him. Job performance, then, is seen as being instrumental for the acquisition of other positively valent outcomes.

The Concept of Expectancy

Whenever an individual chooses among alternatives involving uncertain outcomes, his choice is hypothesized to be influenced by the probability (subjectively assigned) that these outcomes will occur. Expectancy refers to this subjective probability. Values range from zero (subjective certainty that the outcome will not follow the act) to one (subjective certainty that the outcome will follow the act).

There is a distinction between expectancy and instrumentality. Expectancy is an action - outcome association, and takes on values described above. Instrumentality, however, is an outcome-outcome association. Its values range from -1 (the belief that attainment of the second outcome is certain without the first and impossible with it) to +1 (the belief that the first outcome is a necessary and sufficient condition for the second).

The Concept of Force

What remains now is to combine the concepts of valence and expectancy in a predictive model. Vroom made the assumption that behavior is the result of a field of forces having direction and magnitude. On the assumption that individual choice is subjectively rational, he made the following proposition:

> Proposition 2. The force on a person to perform an act is a monotonically increasing function of the algebraic sum of the products of the valences of all outcomes and the strength of his expectancies that the act will be followed by the attainment of these outcomes.
>
> In equation form:
>
> $$F_i = f_i \left[\sum_{j=1}^{n} (E_{ij} V_j) \right] \quad (i = n+1 \ldots m)$$
>
> where F_i = the force to perform act i
>
> E_{ij} = the strength of the expectancy that act i will be followed by outcome j
>
> V_j = the valence of outcome j
>
> (Vroom, 1964, p. 18)

As a means of further understanding, consider the implications of this expression of force. An outcome, regardless of its valence (positive or negative), will have no effect on force unless there is some expectancy that the outcome will be attained. As the probability of attaining an outcome increases, the valence of that outcome exerts greater influence on force. Similarly, if the valence for an outcome is zero (indifference), force will not be ef-

fected.

Methodological Issue

The interactive effects of the several variables have been the source of several efforts to formulate new models, to make extensions to Vroom's basic propositions, and to make empirical examinations of both the basic model and its extensions. These areas are discussed in more detail in Section II of this work. Specifically of interest now, however, is an issue which appears in nearly all of the literature and research addressing expectancy theory; methodology. The vast variety of evidence, both supportive and non-supportive, has caused more than one author to express doubt about not only the theory, but also about the research means employed. Reinharth and Wahba (1976) stated

> "... no fruitful developments can be expected from research dealing exclusively or even primarily with the original variables of the theory without resolving the basic logical and methodological issues ..." (p. 270).

Other authors, without making that type of specific statement, have presented the same thoughts.

As a means of addressing the methodological issue, this research employs a technique new to this type of research -- policy capturing.

Policy Capturing

A more thorough discussion of policy capturing is

presented in Section II of this report. At this point, however, it is necessary to explain the meaning of this type of research mechanism.

Simply stated, a "policy" is a quantitative expression of an individual's decision making process. (Within the literature the decision maker is usually referred to as a "judge".)

As an example, assume that an apple was to be graded on an eleven point scale, where 0 is rotten, and 10 is the best. To judge the quality of each apple, there are three characteristics: color (C), size (S), and weight (W). For every apple each characteristic is assigned a quantitative representation: C - consecutive shades of red, with four shades possible; S - height and circumference, in inches; W - ounces. By observing a number of decisions of a particular judge and knowing both his decisions (of quality) and the quantitative representations of every apple he judged, the weight that the judge gives to each characteristic can be determined. The quantitative statement of these weights is then a mathematical representation of the judge's "policy".

Policy capturing then is a technique to determine and quantify an individual's (judge's) behavioral choice process under a given set of circumstances. If the policy statement is an accurate descriptor of behavioral choice, this then becomes a powerful technique for the examination

of expectancy theory.

Problem Statement

Vroom's original, conceptual model of human behavior has undergone a variety of critical examinations and/or revisions. Researchers have subjected several behavioral models, or portions of models, to empirical tests, attempting to produce evidence substantiating the premises that are the basis of the model: individuals, in a voluntary setting, are rational, cognitive beings who choose among alternatives in such a manner as to maximize pleasure (or minimize pain); behavior is dependent on the individuals peculiar situation and perceptions at the time of the act (choice); and history plays a part in determining how things came to be, but plays no part in behavioral choice.

Lawler and Suttle (1973), Behling and Starke (1973), and Mitchell (1974) all made mention of the trend in ongoing research - it is becoming more involved with the extension and refinement of the theory. Meanwhile, the very basic beliefs about the model, and about the interactive relationships of the variables, are unconfirmed and undenied.

An airplane won't fly without flight controls, and flight should not be attempted until after their operability has been confirmed. Any complex tool should be given the same critical scrutiny. Examine the basic tenets of the cognitive model, and determine the functional ability, before integrating it with more parts and trying

to make the whole fly. Examine the basic propositions, the valence and effort models, and prove or disprove their value -- and then extend and refine if able.

This thesis is an examination of the very basic tenets of expectancy theory as proposed by Victor H. Vroom. Specifically, the use of the policy capturing technique provides a data base which is used to examine the following research questions:

1) Does the use of second level valence increase the accuracy of the prediction of first level valence?

2) Does the multiplication of first level valences by expectancies aid in the prediction of effort?

3) Is expectancy a continuous variable (values ranging from 0 to +1), or is expectancy a dichotomous variable (values 0 and "some")?

II. Developments in Expectancy Theory and Policy Capturing

Recent literature reviews by Mitchell (1974) and by House, Shapiro, and Wahba (1974), presented a similar conclusion: little has been done in the way of constructing or formulating a new, original cognitive model of behavior. Further research of more current literature failed to alter this conclusion. What has been done is widespread modification of Vroom's original model. Numerous researchers have offered conceptual models, but in many instances the models are extremely complicated, and the authors provide little explanation as to how the several variables interact. Many of these models may in fact be perceptually correct, but the lack of specific relationships among variables renders the models almost useless for large scale testing or application. The models merely provide the reader another view of individual behavior.

Some researchers, however, have made specific alterations to the model presented by Vroom. In general, the major changes have fallen into four categories: 1) modifications which incorporate a distinction between first and second level outcomes, 2) recognition of intrinsic sources of valence, 3) the definition of an additional level of expectancy, and 4) elaboration of the model to include other variables (House, et al., 1974).

First and Second Level Outcomes

Galbraith and Cummings (1967) and Porter and Lawler (1968) were the first to make a distinction between first and second level outcomes. First level outcomes are those which interest the manager; those work results derived directly from effort. Second level outcomes are those which are a result of first level outcomes; pay, promotion, dismissal.

The result of this modification was a combination of Vroom's valence and effort models. Stated in mathematical form, the Galbraith and Cummings model is:

$$W = E\left(\sum_{j=1}^{n} I_{ij} V_j\right)$$

W = effort

E = the expectancy that effort leads to performance

I_{ij} = the instrumentality of performance for the attainment of second - level outcomes

V_j = the valence of the second - level outcome

n = the number of outcomes

(Mitchell, 1974, p. 1055)

The greatest significance of this formulation is that it now has only one first - level outcome; performance. All of the things which result from performance then become second - level outcomes. The implication of this is that if an individual perceives a zero probability (expectancy) that any level of effort will lead to performance, his level of effort will in fact be zero

(Mitchell, 1974).

Vroom's original effort model, however, would only predict zero effort in two cases: 1) the expectancy that act i would result in outcome j is zero for all j, or 2) the valence for all outcomes of act i is zero for all j. The distinction here is that, in Vroom's model, there are a number of outcomes associated with effort. In the revised model, performance was the only outcome.

Intrinsic Valence

In the original formulation of the model, Vroom made explicit reference to the exclusion of intrinsic properties of outcomes.

> "The strength of a person's desire or aversion for them [outcomes] is based not on their intrinsic properties but on the anticipated satisfaction or dissatisfaction associated with other outcomes to which they are expected to lead" (Vroom, 1964, p. 16).

What this means is that an individual takes a job not because he might enjoy the work, but only because of the attractiveness of what he sees as a result of the work. Vroom did, however, recognize the existence of intrinsics. He stated:

> "We do not mean to imply that all the variance in the valence of outcomes can be explained by their expected consequences. ... and people may seek to do well on their jobs even though no externally mediated rewards are believed to be at stake" (Vroom, 1964, p. 16).

Regardless, the original valence formula does in fact measure valence only as a function of the valence of

associated outcomes.

Galbraith and Cummings (1967) extended the theory in an attempt to include intrinsics, again pointing out that the work behavior, in itself, has an associated valence. An enjoyable task may draw an individual to it, even though the valence (as stated by Vroom) of associated outcomes is low compared to the valence of outcomes from some other less enjoyable task. The reason for this is the valence associated with that enjoyable task. In another light, the individual may work at a repulsive job because the valence of associated outcomes is significantly higher than those of a more enjoyable task.

Beyond this, House (1971) specified two kinds of intrinsic valences:

> "1) intrinsic valences of behavior-those associated with task performance, such as the development of valued skills or social satisfaction in interpersonal tasks; and 2) intrinsic valences of accomplishment-those associated with task goal accomplishment, such as pride in work or the satisfaction of achieving a challenging goal" (House, et al., 1974, p. 484).

Campbell, Dunnette, Lawler, and Weick (1970) made a similar modification to the basic model to account for aspects of behavior which are not clearly extrinsic.

> "In the model, two facets of motivation are included, one based on external task goals and one on internal task goals. External task goals are specified by someone else, while internal task goals are specified by the individual based on his or her value system" (Broedling, 1977, p. 272).

These internal task goals would take on an intrinsic

valence, and the goals specified by someone else would become valent (positive or negative) because of the valence of their associated outcomes.

Expectancy I and Expectancy II (EI and EII)

The final major modification to the model came about when Campbell, Dunnette, Lawler, and Weick (1970) made a distinction between two types of expectancy (Mitchell,1974). With their concept, EI is that perceived relationship between effort and goal achievement. In other words, what is the probability that effort will result in the accomplishment of the task goal? EII, however, is the perceived probability that goal accomplishment will result in the desired first level outcome (may it be performance or some other issue such as pay). In the words of the authors, "individuals possess expectancies concerning whether or not achievement of specified task goals will actually be followed by the first level outcome (expectancy II)" (Campbell, et al.,1970, p346). What must be understood is that the first level outcomes, as seen by Campbell, et al., are really what most other authors/researchers consider to be second level outcomes. There is then an extreme parallel between this conceptualization of EII and Vroom's original statement of instrumentality, except that EII is a probability (0 to +1) and instrumentality is a correlation (-1 to +1). This has caused some problems in operationalizing the concept.

Inclusion of Specific Variables

Many researchers have made modifications to one of the existing models in order that they might examine a variable (or variables) which they feel might add more meaning to the model as a whole. Mayes (1978), for example, was concerned with the importance of the performance - reward time lag. He proposed that time be incorporated in the model as the "forgotten variable," and reformulated behavioral choice as a function of EI, EII, V, and a time based discount factor. Mayes offered no empirical test of the model, but logic would seem to point to time as a factor. The exact interactive effect could only be determined through empirical research.

Rockness (1977) examined another version of the model which allowed for a multiple goal, multiple outcome setting. The result of the formulation was that the rewards include the cost of effort in achieving performance. Maximum effort would be directed toward that level of performance resulting in the largest net expected rewards. The empirical research Rockness conducted on this modification indicated that the individuals acted as predicted, with few exceptions. The conditions for the experiment (primarily time and resource constraints), however, were such that Rockness felt that any policy implications were "tenuous at best" (p. 899).

Within the literature, there are many more examples

of minor modifications to the behavioral model, but beyond the three major modifications which have already been discussed, none have received wide - scale recognition of empirical study. For this reason, the remainder of this section examines only the research which has been conducted on the original model, or on the major modifications discussed above.

Empirical Examination of Expectancy Theory

A number of researchers, under a variety of conditions, have collected data and performed an empirical analysis of an expectancy model. Consideration must be given, however, to the particualr model in question. Specifically, the literature yields two general areas of research: 1) that aimed at testing the basic valence model (ΣIV), and 2) efforts which examine a force model, either in the form of Vroom's proposition (ΣEV), or of the form $E\Sigma IV$, where E represents the expectancy that effort will lead to performance.

Tests of the Valence Model. The power of this model supposedly lies in its capability to predict the valence of an outcome through the calculation of ΣIV. In varied instances, it has been used to predict job satisfaction, occupational preference, and the valence of performance. Mitchell (1974), in a review of the research to that date, concluded that most of the tests of the valence model provided supportive evidence of the predictive utility of

the model. Specifically, "the more accurately the investigation reflected the original Vroom model, the better the results" (p. 1058).

Eran and Jacobson (1976) found moderate support for the valence model. In this study, the criterion variable was a measure of the "desirability of continued employment versus retirement if assured of full pension benefits..." (p. 606). Employing multiple regression, the authors recorded a correlation between the criterion variable (c) and the predicted valence of $R_{c,v} = .4$ ($p < .01$). From the results of this study, the authors concluded that "valence and instrumentality concepts from expectancy theory are useful in understanding the process of choice..." (p. 610).

Not all research, however, has resulted in strong positive support. Turney (1974) conducted research aimed at an examination of first level valence and another variable which he called Intrinsic Activity Value (IAV), both of which he felt were valuable in the prediction of effort (force). IAV is a measure of affective pleasure experienced by an employee while performing a work activity. IAV forcuses on the present, whereas E x V is future oriented. Respondents rated the contribution of high technical competence to the attainment of eight possible second level valence. The relevant first level outcome was the "competent performer role" (p. 73). The correlation

between this and the composite first level valence = f Σ IV was only .27 ($p < .01$). To say the least, the verdict is not yet in.

<u>Tests of the Effort Model</u>. Effort, as modeled by Vroom and those that followed, is viewed as a measure of behavioral choice. Empirical studies of the model have examined either the basic formulation, ΣEV, or following Galbraith and Cummings (1976) and Campbell, et al. (1970), the more complex formulation, EΣIV (Mitchell, 1974).

The results of the research on the effort model have generally been less supportive than for the valence model. Causation may lie in the difficulty encountered in the operationalization of the basic concepts, particularly in the more complex formulations using EII and intrinsic/extrinsic valences. Extensive literature reviews by Mitchell (1974), Wahba and House (1974), and House, et al. (1974), all resulted in similar conclusions - the evidence for the validity of the model was less than consistent, and there is a great deal of variance in the methods employed in operationalizing the primary concepts.

More recent findings appear to be as varied as that preceding Mitchell's 1974 review. Lawler, Kuleck, Rhode, and Sorensen (1975) reported a correlation of .40 ($p < .01$) between ΣEV and the choice criteria. This study employed accounting students, and the choice criteria was the completion of an actual job interview with one of eleven accounting firms. The somewhat weak results may be due in

part to the little variance found in the ratings of the eleven firms. (Mitchell and Beach, 1976)

Matsui, Kagawa, Nagamatsu, and Ohtsuka (1977) tested the effort model on sixty-two female life insurance representatives in Japan. A significant relationship existed between force and performance ($\chi^2 = 72.94$, $p < .001$). In general, the data supported the hypothesis that "subjects more frequently sold those types of items associated with the larger force score" (p. 766).

Reinharth and Wahba (1976) examined nine different predictor models, including additive, multiplicative, and compound versions of the variables. The findings were as varied as the models tested, with individual models accounting for significant amounts of variance in effort, performance or satisfaction; however, no single model was consistently superior to others. In short, the findings did not support the theory as a strong predictor of effort or performance.

In all of the studies cited above, and in nearly all of the research literature, there is at least mention of the methodological issue. In many instances, the methodological question is the motive for the research. As with the cognitive models, there are many varied ideas and techniques.

Methodological Problems

Nearly every author in the field of cognitive behavior

has an independent view or perception of the basic concepts of the various models. Concurrent with these differing perceptions is a variety of techniques employed in an attempt to measure (quantify) the concepts and provide some basis for empirical examinations of the models. First and foremost, what is the best means of measuring the variables germain to the model -- valence(s), instrumentalities and expectancy? Secondly, how many outcomes should be used, and from what source? Thirdly, should the model be examined in a within - person or across - person setting? The discussion presented here does not necessarily provide an answer to these questions; it merely sheds some light on the differences in the field.

<u>Measurement of Variables</u>. The type of model under examination is not of importance here. At issue is the differing means and terms employed to quantify the variables. Matsui and Ikeda (1976) obtained valence measures through subject's ratings of the "degree of importance" of a list of ten outcomes, and expectancy measures were described as "expectations" that effort would lead to attainment of each of the ten outcomes.

Muchinsky (1977a), in a study on student effort, operationalized valence by asking respondents to rate the "attractiveness" of outcomes on a -10 to +10 scale. Instrumentalities were recorded through ratings of

> "the relationship between performing well in the course and attaining each of the outcomes. These ratings were made using a -10 to +10 scale, with

> the ratings representing whether good performance contributed to or detracted from the possibility of attaining each outcome" (p. 155).

An expectancy measure was provided by respondents indicating on a 0 to 9 scale the relationship between effort and performance (9 = very strong, 0 = no apparent relationship).

In a research study specifically designed to test different measures of expectancy - valence components, DeLeo and Pritchard (1974) examined valence as both "importance" and as "attractiveness"; instrumentality was examined, on a 17 - point Likert scale as a "correlation" between performance and outcomes, and secondly, as a probability that performance would result in each of the outcomes; expectancy was measured in two manners similar to the instrumentality measure - first as a correlation on a 5 - point agree - disagree Likert rating format, and then as a probability of high effort resulting in high performance. The conclusion of this study was somewhat foreseeable -

> "The procedure of testing expectancy - valence models with survey methodology seems clearly inappropriate given the quality of the measuring instruments currently available. Instruments must be developed which demonstrate adequate reliability and construct validity. Authors utilizing measures of expectancy - valence constructs which have not been carefully evaluated are treading on dangerous ground indeed" (DeLeo and Pritchard, 1974, p. 148).

Outcomes. There has been and continues to be, some question as to how many outcomes are useful in the study of cognitive behavior. Parallel questions, possibly of less

importance, concern the source of outcomes, and the inclusion of both positive and negative outcomes.

The number of outcomes an individual can realistically accomodate in his cognitive thought process has become a point of issue. Normally, this addresses the list of second level outcomes. DeLeo and Pritchard (1974) used 51 outcomes, Muchinsky (1977b) used eleven, and Reinharth and Wahba (1976) had a list of twenty-nine items. The truly inquisitive (dogmatic might be a better term) could find any desired number of outcomes in the research literature.

There is, however, a critical aspect to any list of outcomes. In most cases, they are viewed as "possibly relevant", "potentially relevant", or some other similar descriptive term. It is important to realize that, regardless of the length of the list of outcomes, individuals will attach varying levels of importance or attractiveness (valence) to each of those items. In many cases, the valence will in fact be zero, and those outcomes will have no influence on the individual's behavior. Eran and Jacobson (1976) compiled a standard list of thirty-five outcomes in a study to test the valence model in a retirement/continued employment choice situation. Step - wise mutiple regression yielded only three outcomes which made a significant contribution to R. This was true over both groups, those who preferred retirement and those who preferred continued employment. Connolly and Vines (1977)

found that as little as two of twenty-three outcomes provided as much predictive accuracy as the full twenty-three outcome model. This emphasizes what is stated here. Choice is an individual behavior. In a specified situation, with a list of outcomes of length five or fifty, the individual will make his/her decision based on the most valent outcomes. The remaining outcomes will not make a significant contribution.

The second question about outcomes is directed at the source. Are subject - generated outcomes more useful, or meaningful, than a standard list of outcomes? Logic would seem to indicate that a list of outcomes generated by an individual would have more importance, to that individual, than a standard list. Matsui and Ikeda (1976), using ΣEV model, examined this very question. The results of that study provided tentative support for the use of self-generated outcomes. The "tentative" should be emphasized, for "the difference in correlations between the criteria and both ΣEV for the self-generated outcome group and the ΣEV for the standard list group were not significant" (p. 295). In other words, the matter is unresolved.

The final question addressed the need or desirability of including both positive and negative outcomes in a study of any cognitive model. For some list of outcomes, it would seem that for any particular individual, the list would almost certainly contain both positive and negative

outcomes. For a study using subject - generated outcomes, the requirement for negative outcomes would have to be stated explicitly. The difficulty here lies in specification of the first level outcome. A subject may or may not be able to supply both positively and negatively valued second level outcomes related to a specified first level outcome. Reinharth and Wahba (1976), in a study of nine predictor models, concluded that, with respect to effort and performance, using both positive and negative outcomes did not seem to improve the predictive power of the thoery.

Within - Person versus Across - Person Examination. One of the points which bears upon methodology is the propriety of within - person or across - person analyses. Mitchell (1974) made a comment concerning his belief that current investigators were misconstruing Vroom's model. His opinion was that Vroom viewed expectancy theory as a with - person model, and most (if not all) investigators were studying the theory with across - person analyses. This viewpoint has led some researchers to focus on the within - person analysis.

Parker and Dyer (1976) and Matsui, et al. (1977), conducted research using the within - person methodology, and in both instances found support for the utility of expectancy theory as a with - person behavioral choice model. Muchinsky (1977a) performed a comparative study of the two analyses, "it appears that ... the results from the

within - subjects analysis offer predictive utility superior to those obtained from the across - subjects analysis" (Muchinsky 1977a, p. 158).

Conceptually, one does not attempt to predict individual behavior through group analysis. This is not to say that group analysis is useless, but to point out that Vroom's original propositions, both one and two, were clearly directed at individual behavior. In both cases, "a person" was used; this term is not group descriptive.

It seems that the major share of the investigative research has employed inferential analysis, attempting to draw valid conclusions about individual behavior from group behavior. As an understatement, this is not an enviable position. Policy capturing, as the research mechanism for this study, provides a means of studying expectancy theory via a within - person analysis. This appears to offer an advantage in that it avoids the inferential, across - subject analysis.

Policy Capturing

The concept of modeling psychological processes has its roots in the behavioral sciences. The concern has been to model or explain an individual's judgemental processes in an uncertain environment. Multiple regression lends itself to this type of analysis, and the availability of modern computers and computational routines has enhanced the use of regression techniques.

The use of multiple regression for modeling human judgement is not what might be considered "new". Brunswick's Lens Model, introduced in 1940, was the first proposal for the use of multiple regression as a model for human use of information. Since that time, it has been utilized in a variety of topical areas. (Beach, 1967)

In most instances, the purpose of a linear regression model is to make an explicit, quantitative statement of a judge's weighting policy. There appears to be little doubt that these models can be an accurate representation of that policy, and in some instances may provide a more "accurate" or "reliable" decision than the original judge. Slovic and Lichtenstein (1971), in a thorough literature review, concluded:

> "It is apparent that the linear model is a powerful device for predicting quantitative judgements on the basis of specific cues. It is capable of highlighting individual differences and misuse of information as well as making explicit the causes of underlying disagreements among the judges in both simple and complex tasks" (p. 679).

It might be asked if this conclusion has been weakened by more recent research. Slovic, Fischoff, and Lichtenstein, (1977), in a review of descriptive decision theory, cited a number of research efforts where regression models were used in the study of several diverse judgement activities, including admissions committees, auditors, literary critics, and even United States Senators. This list is by no means exhaustive. Again, the conclusion was that:

> "As in the laboratory studies, linear equations have accounted for most of the predictable variance in these complex judgements. The coefficients of these equations have provided useful descriptions of the judge's cue- weighting policies and have pinpointed the sources of interjudge disagreement and nonoptimal cue use" (p. 12)

Very little, if anything, can be found to alter or detract from the above conclusions. For the unacquainted, the above cited reviews offer a wealth of background information and numerous examples of applicable research. The work of these authors is not replicated here.

Model Usage

Even though the regression model has a high degree of descriptive accuracy and predictive usefulness, there is still doubt as to how the information derived from the analysis may be used in the study of expectancy theory. This doubt arises from a concern regarding the use of beta vice relative weights, and from the argument, raised by F. L. Schmidt (1973), that many of the scales used in research lack a rational zero point and are at best interval scaled.

Hoffman (1960) stated that "regression weights signify, with certain limitations, the emphasis or importance attached to each of the predictor variables by the judge" (p. 120). The primary limitations include an inability to make comparisons of beta coefficients between judges (because multiple R's are different), 2) the beta co-

efficients do not account for all of the predictable variance, and 3) an inability to assess the independent contribution of each predictor. (Hoffman, 1960).

The latter two limitations can be overcome through the use of orthogonal data. In this instance, there are no covariance terms, and the variance in predictor scores is described by the sum of squared beta coefficients.

The other two limitations can be addressed by speaking in terms of relative weights rather then beta weights. With orthogonal predictors, relative weights are obtained by dividing the respective beta weight squared by the R^2 of the associated regression equation. This then allows not only a comparison of judges, but also an examination of the independent contribution of each of the predictor variables.

Schmidt (1973) raised a question directed at the use of scaled data for the investigation of multiplicative relationships such as are encountered in expectancy theory. If the scales used in measurement lack a true zero point, then the value of each recorded variable differs from zero by some constant. If each of the variables contains some amount of error, the correlation of their product with some other variable can be significantly altered. The determination of the true zero point of a scale is a tedious, time - consuming task, and is rarely undertaken.

Policy capturing is not necessarily a solution to the

multiplicative issue, but careful design can reduce, or perhaps in some cases, eliminate the problem. The specifics relative to this study are discussed under methodology.

Although the use of policy capturing to study expectancy theory is not yet widespread, there have been references to its usefulness. Zedeck (1977) commented upon the ability of the information processing model to provide a reliable and meaningful assessment of the individual's needs and goals. Mitchell and Beach (1977) suggested using the model to study occupational choice and stated that "the policy - capturing technique helps to determine the individual's underlying values..." (p. 213). In this research, the study is of behavioral choice, but the approach is as suggested above.

Summary

It is obvious from all that has been presented here that Vroom's basic propositions have yet to be proven. On the other hand, they are undenied.

Research efforts concerned with the entire realm of cognitive behavior have produced mixed results. The valence model has received the greatest support, but it is also the simplest form to operationalize. The effort models have been examined in numerous settings, but the results have been of less than the desired magnitude. This may be due to the greater complexity of the models in general (vice the valence model). Operationalization of

a greater number of concepts, over a number of models employing different terms for similar concepts, must certainly contribute to the variability of the evidence.

The methodology employed to investigate cognitive behavior continues to be of some concern. Certainly, data collected for analysis are only as good as the mechanism used to record that data; and any conclusions or inferences based upon that data are strengthened or weakened by the same argument. One could hypothesize that the investigation of a specific circumstance, using different methodologies, would yield as many results as methods employed.

Policy capturing is not a complete solution to all of the methodological issues. It appears, however, to be an improvement over the vast array of techniques employed previously, and as such may be a step toward a final solution. To state what has become a well known phrase, "output is only as good as imput." Perhaps no final conclusion has surfaced because the proper means of unearthing it has yet to be found. Hopefully, the methodology and results of this research will convince others to explore new means of performing research on human behavior.

Not withstanding methodology, a final conclusion on the basic tenets of Vroom's model is necessary before it can be expanded or refined. If denied, it should be discarded. This thesis is a return to those basic tenets -- research aimed at exploring the merits of Vroom's propositions concerning cognitive behavior.

III. Methodology

Introduction

The primary purpose of this study is to investigate the value of Vroom's basic propositions, the valence and force models, as models of cognitive behavior. This chapter is a presentation of the methods and techniques employed in the analysis. A great amount of detail is devoted to the procedure employed to construct the policy capturing instrument, for the data collected through distribution of the instrument forms the basis for the research; and the value of the final analysis rests upon the accuracy and validity of that data.

Population Identification

The amount of effort expended in an academic environment and the outcomes associated with that effort are certainly meaningful to the author and his peers as graduate students. Therefore, a logical and convenient choice for a sample population was those graduate students (and Air Force officers) willing to participate in a decision making exercise.

Previous research efforts with similar exercises and voluntary participation resulted in approximately a 50% return rate. With a target of 50 respondents, 100 exercises were printed for distribution. Within the decision making

exercise was a plea for assistance for a fellow student (the author) and a promise of feedback if desired. With the combination of these factors and such a pertinent topic, it was hoped that the return rate would exceed 50%.

The Policy Capturing Instrument

The final form of the Decision Making Exercise is shown in Appendix C. It includes ten questions on demographic data, 24 hypothetical courses requiring two decisions each, and a final set of four questions, three from the Rotter scale and one for subjective weighting of the three second level outcomes.

The construction of the decision making exercise was a prolonged effort requiring several steps. Morris (1978), in an investigation of job preference and job choice, employed a similar decision making exercise. This provided a basic format, but it required alteration to match the specific circumstance of an academic environment. The intent, from the outset, was to construct an exercise with a full factorial design, over three levels of expectancy, which would yield orthogonal data. This point should be kept in mind, for it is important.

The first step was to identify that outcome which students believed to be most attractive (valent) to them in academic endeavors. A group of 13 classmates was asked, a priori, to list all of those factors, positive or negative, which it felt were associated with academic efforts.

TABLE I

Results of Course Effort Survey

FACTOR	AVERAGE RANK
Relation between effort and grade	2.70
Relation between course material and future courses, AF job, and thesis work	3.06
Relation between subject matter and personally interesting subjects	3.12
Personality, attitude, and competence of instructor	5.06
Clarity of course objectives	6.82
Amount of time available considering other courses	4.94
Personal satisfaction from effort	3.77
Grading scheme of the instructor	5.94

The results of this initial step were condensed into a list of eight outcomes and put in the form of a Course Effort Survey (Appendix A). The survey was then distributed to another group of 15 students to determine the most important factor associated with effort. The results, shown in Table I, clearly indicate that the most important factor is the course grade. This in turn led to the conclusion that a high course grade (an A) would be the first level outcome to be used in the Decision Making Exercise.

The next step was to determine what outcomes (2nd

TABLE II

Outcomes associated with an A

	Outcome	Occurrence
1.	Personal Satisfaction	12
2.	Distinguished Graduate	3
3.	False Sense of Security	1
4.	Animosity of Classmates	3
5.	Ability to absorb a C in another course	5
6.	Recognition	3
7.	Improved Grade Point	3
8.	Esteem of Classmates	5
9.	Personally imposed pressure to remain on top	1

level) students associated with receiving an A in a course. A simple survey sheet (Appendix B) soliciting this information was given to another group of students. The purpose was to identify the second level outcomes, but not to rank them, for this was not necessary. As discussed earlier, there has been some question as to the value of "standard" lists of outcomes employed in this type of research mechanism. With a factorial design, using voluntary participation, the use of respondent-specific outcomes was an impossibility. The choice of those outcomes relevant to the greatest number of individuals, however, provided a set of outcomes which will at least have meaning to the popula-

tion under study and yet still provide the flexibility required for the exercise.

Table II is a listing of all the outcomes provided by the respondents. Some of these were in turn condensed into single outcomes of similar wording and meaning: 1) outcomes 3 and 6 became recognition as a Distinguished Graduate, 2) 4 and 8 became regard of classmates, 3) 3, 5, and 7 became improved Grade Point Average (GPA), and 4) personal satisfaction, listed by nearly every respondent, remained unchanged as the fourth outcome.

Vroom's original concept speaks of instrumentalities which can have values from -1 to +1. For this reason, the initial desire was to have outcomes with both a positive and negative instrumentality. The format of the hypothetical courses for the original decision making exercise is shown in Figure 1. Even though Personal Satisfaction was the most often listed outcome, it was not used because it was difficult to conceptualize a negative instrumentality associated with that outcome.

With three second level outcomes and three levels of expectancy (0, .4, .8), a full factorial design yielded $2^3 \times 3 = 24$ hypothetical courses. The three levels of expectancy were chosen for two reasons. First, the use of these figures would result in orthogonal data. Secondly, the use of 0 and two positive points (one at the mid - range and one high) would allow the test for the dichotomy of expectancy, as well as allow testing over a more com-

The relationship between an A in this course and ...

... recognition as a Distinguished Graduate is ....VERY POSITIVE

... an improved GPA (so much effort was required for this course you received lower grades in other courses) is ....VERY NEGATIVE

... the regard of your classmates is ....VERY POSITIVE

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
Very Unattractive										Very Attractive

Further Information. If you exert a great amount of effort, the likelihood you can get an A is high (probability = .80).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much effort you would exert in this course to get an A:

0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10
No effort to get an A										Great effort to get an A

Figure 1. Format of hypothetical courses for original Decision Making Exercise

plete range of expectancy. Using the format of Figure 1 the 24 courses were arranged in random order and a complete exercise created. This was then pretested on a group of 14 students, of which 9 responded. Included with this pretest was a solicitation for comments or questions directed at completing the exercise.

The results of the pretest produced a marked change in the format of the exercise. Nearly all of the respondents recognized the dependence between the first two outcomes, GPA and recognition as a Distinguished Graduate. No statistical analysis was performed on the results of the pretest, for the immediate decision was to change the format. At this point, there was a realization that Vroom's statement of instrumentality was not as restrictive as had been applied in the original exercise format. Instrumentality can in fact have values, for some outcomes, which may be non-negative or non-positive. In this instance, for example, how could receiving an A in a course prevent a feeling of personal satisfaction (-1 instrumentality)? An instrumentality of zero, however, is entirely possible. This simply means that receiving an A in a course brings no personal satisfaction.

The instrumentalities associated with the outcomes then became 0 and +1, represented by ZERO and VERY POSITIVE in the exercise. This change allowed the use of Personal Satisfaction as a second level outcome, a desirable action

in light of the fact that it appeared to be a relevant outcome to nearly every respondent. In conjunction with the inclusion of Personal Satisfaction as an outcome, the two related outcomes, GPA and recognition, were reduced to a single outcome, improved GPA. Again, a complete exercise with 24 hypothetical courses ($2^3 \times 3$) was created and pretested.

The exercise was distributed to 17 students, of which 13 responded. Again, comments were solicited. The purpose of the pretest was twofold. First and foremost was a desire to determine the internal reliability of the instrument. A measure of that reliability is the R^2 of the regression analysis, where Decision A is regressed on the instrumentalities associated with the three second level outcomes. For the 13 respondents, the average R^2 was .800, with a range of .601 to .975. This was excellent, and no further change was necessary to this part of the course format.

The comments returned with the pretest led to one change in the response scale for Decision B. Some individuals indicated a difficulty in determining the amount of effort to put forth because there was no explanation as to the consequences of no effort. Would no effort result in a B? In a C? Two actions were taken to clarify Decision B. First, the anchors were changed to read "No" or "Great" <u>additional</u> effort to get an A. And, in the introductory pages of the exercise, a special note was added to

the sample course format, explaining that the individual's current level of effort would result in receiving a B in the course.

Examination of the pretest also precipitated an addition to the exercise. Of the 13 respondents, only two answered 0 for Decision B (no additional effort) on all of the courses where expectancy of receiving an A was zero (probability = 0). A possible explanation for this was thought to lie in the individual's perception of generalized reward contingencies, or locus of control as proposed by Rotter, Chance, and Phares (1972). It was hypothesized that an individual with an internal locus of control would have a higher score on the Rotter scale than an individual with an external locus of control. Internal individuals were identified as those who exhibited variance on Decision B for those eight courses where the probability of receiving an A was zero. To address this possibility, three questions relating to the academic environment were taken from the Rotter scale and attached to the exercise. These questions were placed such that they would be completed only after completion of the 24 hypothetical courses, and would not influence the decisions involved.

One other item was attached with the Rotter questions. This was a request for the respondents to subjectively distribute 100 points among the three second level outcomes according to his/her belief about how much relative

weight he/she attached to each outcome. The correlation between the relative weights of the regression analysis and the respondents subjectively assigned weights then provides a measure of the insight of the decision maker.

One last change was made to the exercise. It was desirable that respondents recognize, without specific direction, the existence of three probability levels relative to Decision B. This was accomplished by interchanging two of the courses so that the first three hypothetical courses each had a different level of probability associated with Decision B. This provided a means of highlighting the three levels of probability without specific reference. This avoided "teaching" the respondents in an area directly related to the research subject.

This completed the exercise (Appendix C). Vroom's concept of valence (1st level) is measured as "attractiveness" on an 11 point Likert scale, with anchors of Very Unattractive and Very Attractive at -5 and +5, respectively. The instrumentalities for the second level outcomes are stated as ZERO or VERY POSITIVE, representing 0 and +1. Expectancy is stated as a probability in the Further Information block, and three levels (0, .4, .8) are used in the exercise. This results in 24 (2^3 x 3) hypothetical courses for a full factorial design. A value for effort is recorded on an 11 point Likert scale, with values from 0 to +10 and anchors of "no additional effort to get an A'

and "Great additional effort to get an A". With this format, each respondent would record 24 valence decisions and 24 effort decisions, for a total of 48 data points per respondent.

Data Analysis Techniques

The analysis of the data gathered from the decision making exercise was accomplished using selected programs from the Statistical Package for the Social Sciences (Nie, et al., 1975). The actual mathematical computations are not addressed here because all of the routines are common to behavioral research. Applications of the routines specific to this research are described below.

Frequency Distribution. A frequency analysis was used for two portions of the research. It provided descriptive statistics for the sample population, and it was used to isolate those individuals with variance (Decision B > 0) on those questions where the probability of receiving an A was zero (0).

Regression Analysis. Each individual made 24 valence (attractiveness) decisions. These decisions were regressed on the instrumentalities associated with the second level outcomes and the results used for two purposes.

First, the R^2 of the regression equation provides a measure of the internal reliability of the policy capturing instrument. The appearance of a consistently high R^2 is desirable, for the lack of it would weaken the results

of the over - all analysis.

Secondly, the regression analysis was used in addressing the first research question (concerning the valence model). The beta - weights of the regression analysis represent the second level valences. The R^2 of the regression is then the amount of explained variation provided by Vroom's valence model (ΣIV). An important aspect of the regression analysis is that it avoids the issue raised by Schmidt (1973). The beta - weights are pure numbers and the instrumentalities are stated values, so there is no error in the multiplicative terms.

Correlation Analysis. Correlation analysis provided the bulk of the statistical data used in the research. Primarily, r^2 represents the amount of variation one variable, or combination of predictor(s), can explain in the value of a second distinct variable (criterion). This approach was used in addressing all three research questions.

Also, correlations were obtained between the relative weights from the regression analysis and the subjective weights assigned by the respondents, and between GPA and hours studied.

Factor Analysis. Factor analysis was used only to examine the reliability of the Rotter scale. There was some concern because only three questions were used. The factor analysis provided variances for each of the Rotter questions. These variances, along with the variance of

the sum, were used to calculate coefficient alpha.

Statistical Test. Only one statistical test was used in the analysis --the t - test. All of the correlations and regressions were for individuals, which necessitated the use of a paired sample t - test to examine the difference in two means. The mathematics of the paired sample t - test are presented in Appendix D. The t - test for the difference in means as applied to the Rotter scores is described at the end of Appendix L.

IV. Results

Sample Identification and Return Rate

Great care was taken to identify any and all of those students who had participated in, or had any contact with, the process of constructing the policy capturing instrument. These students were eliminated from possible inclusion in the research sample, removing the possibility of biased data resulting from learning.

To preserve anonymity, students were identified only by student box number. Of the 100 exercises printed, eight were retained for administrative reasons, leaving a total of 92 for distribution. Using the existing administrative records, 92 box numbers were chosen (random selection) to identify the recipients of the decision making exercise.

The return rate was much as expected. Of the 92 distributed, 53 completed exercises were returned, a 57% return rate. Of these 53, however, three were unuseable, for various reasons (missing data, for example). This lowered the meaningful return rate to 54.3%, which was still considered good, and provided an adequate amount of data to conduct a meaningful analysis.

The demographic data describing the sample is listed in Appendix E. In summary, the sample was primarily male (98%) under the age of 30 (78%).

Regression Analysis

The first step in the over - all analysis was to perform the regression of Decision A on the three instrumentalities, constructing each individual's "policy" with respect to the separate second level outcomes. A listing of each respondent's policy equation and associated R^2, along with his/her subjectively assigned weights, is presented in Appendix F.

TABLE III

Summary of Results of Regression Analysis

	Mean Beta-weight	Mean Relative weight
Grade Point Average	.513	.4411
Regard of classmates	.181	.0798
Personal Satisfaction	.585	.4791
Average R^2 of individual regression equations = .8243		

A summary of the results (averages) is shown in Table III. R^2 ranged from .384 to 1.000, but the next to lowest was .517, with an average R^2 of .8243 (shrunken R^2 = .8087 [Cohen and Cohen, 1975, p. 106]). These facts point to the over - all internal reliability of the policy capturing exercise.

In conjunction with the regression analysis, another check of the exercise was accomplished through a cor-

relation analysis between the computed relative and subjectively stated weights. These correlations were .8587, .6546, and .7663 for each of "GPA", "regard of classmates", and "personal satisfaction", respectively. This again is an indication of the ability of the exercise to capture and reflect individual feelings regarding the specific associated outcomes.

Both of the above findings lend confidence to the data. Thus confidence in the analysis is strengthened, and ultimately so are the conclusions drawn from that analysis.

General Approach

The research questions of this work are all addressed through an examination of the explained variation provided by a particular model. These data were obtained through two methods, either regression analysis, or correlation analysis. The results were then examined statistically through the use of a paired - sample t - test using a two tailed test with $p < .01$.

For those tests involving correlation analysis, some sets of data resulted in uncomputable coefficients, leaving as little as $n = 47$ cases for specific statistical tests.

Test of the Valence Model (ΣIV)

The valence model is represented by the regression equations as presented in Appendix F. In this instance, the beta weights represent the valences assigned by the

individual to each of the three second level outcomes.

To test the model, an equally weighted sum of the three instrumentalities (ΣI) was correlated with Decision A. The ΣIV model was then hypothesized to be a better predictor (explain more variation) then the ΣI model.

The R^2 of the regression analysis and the square of the correlation of ΣI with Decision A (r^2), along with the hypothesis and associated t - test, are presented in Appendix G.

What the data indicate ($t = 9.254$) is that the beta weighted sum, or valence model (ΣIV), holds a greater predictive capability than does ΣI, an equally weighted sum of the instrumentalities.

This is clearly supportive of Vroom's Proposition 1, the valence model. Individuals, as cognitive beings, do assign some attractiveness, or valence, to particular behavioral outcomes. That attractiveness is dependent upon the valence of outcomes which may (or may not) result from the first level outcomes.

<u>Test of the Force Model (ΣEV)</u>

Force, as defined by Vroom, is determined by the sum of the product of expectancy and the first level valences. Within the decision making exercise, expectancy is manipulated through the use of three levels of probability associated with receiving an A. The motivational force of each individual, for each hypothetical course, is re-

corded as "additional effort". Theoretical force is obtained by multiplying Decision A (1st level valence) by the probability of receiving an A (expectancy).

To test the force model, theoretical force was correlated with Decision B and Decision A was correlated with Decision B. This was accomplished over all three levels of expectancy, and the two correlations (squared) compared to determine which explained the greater amount of variance.

The square of the correlation coefficients for both cases and the associated t - test are presented in Appendix H. Again, the data were supportive of Vroom's model. With $t = 6.5196$, the data indicate that the force model is a better predictor of effort than is Decision A alone.

Test of Expectancy as a Dichotomous Variable

Examination of the behavioral characteristics of expectancy was a slightly more complicated affair. In this case, it was necessary to isolate the effects of each level of expectancy. This isolation was obtained by conducting the correlation analysis much as described for the test of the force model. However, three distinct analyses were performed. Each analysis excluded a level of expectancy i. e. cases were selected on the basis of expectancy $\neq 0$, $\neq .4$, and $\neq .8$, respectively. If identical results appear for each analysis, then expectancy is indeed a continuous variable. If different results appear, then

it is an indication of a dichotomous, or at least discontinuous, variable. Results of the analysis are shown in Appendix I.

The data are indicative of a dichotomous variable. For the analysis where expectancy $\neq 0$, the data failed to reject the null hypotheses, indicating that Decision A was as good a predictor of effort as hypothetical force ($t = 1.2363$). For the analysis where expectancy $\neq .4$ and $\neq .8$ (i. e. expectancy = 0 was included), the data rejected the null ($t = 7.123$, $t = 5.365$, respectively), indicating that the force model was a better predictor of effort than was Decision A alone. These two results then provide evidence that expectancy is a dichotomous variable, with values of "0" and "some".

It was thought that perhaps the over - all result was due to the effect of those individuals who had no variance on Decision B (i.e. effort = 0 in all cases where expectancy = 0). To examine this possibility, the above analysis was repeated, but only using those students who exhibited some variance on Decision B.

There were 26 students (Appendix J) who had variance on Decision B. Analysis of their responses provided indications very similar to the results of the sample as a whole. When expectancy $\neq 0$ and $\neq .4$, the results were identical to that above ($t = .6093$, $t = 3.294$, respectively). However, in that analysis where expectancy $\neq .8$, the results

were different. The t valve was 1.473, with a critical value of $t_{.005, 25} = 2.787$.

These results indicate that the over - all result for the sample was not caused by an over - riding affect from those individuals exhibiting no variance on Decision B.

All of these data indicated the desirability of one other test. In the original analysis, the force model was compared to Decision A as a predictor of effort. All three levels of expectancy were used, and the data provided support for the model. If expectancy is a 0/1 variable, the data should yield similar results if collapsed to that specific scale. The .4 and .8 values for expectancy were both recoded as equal to 1 and the analysis repeated.

With the collapsed scale, the data still provide support for Vroom's model (Appendix K, t = 6.7708). This again indicates that expectancy is a dichotomous variable with values of 0 and 1.

<u>Locus of Control</u>

It was hypothesized that those students exhibiting variance on Decision B when expectancy was zero would have a higher Rotter score than those with no variance.

The categorization of students and the associated statistical analysis is provided in Appendix L. For students with and without variance on Decision B, the mean score was 2.0 and 1.708, respectively. With t = .9658, the data do not indicate any difference in scores. This in turn

would indicate, for this sample, that an individual's perception of generalized reward contingencies has little or no influence on his/her determination of how much effort to exert.

TABLE IV

Results of Factor Analysis

Factor	Eigenvalue	Pct of Var	Cum Pct
1	1.71513	57.2	57.2
2	.85537	28.5	85.7
3	.42950	14.3	100.0

Factor Loading Matrix Using Principal Factor

Variable	Factor 1
R1	.64768
R2	.87168
R3	.73200

There was concern over the reliability of the Rotter score because only three questions were used. Factor analysis of the data, however, showed very favorable results (Table IV).

As can be seen, there was only one major factor and all three Rotter questions had similar loadings. The calculation of coefficient alpha (Appendix M) gave a reliability of .6258. With only three questions, this was considered excellent. However, because the Rotter

TABLE V

Summary of Paired Sample t-test for Explained Variation

Variable	Mean Squared[a] Correlation Coefficient	df	t
Decision A, Beta Weighted Instrumentalities	.8243	49	9.254*
Decision A, Equally Weighted Instrumentalities	.5698		
Decision B, Decision A	.285	47	6.5196
Decision B, Hypothetical Force	.551		
1) Expectancy ≠ 0			
Decision B, Decision A	.528	47	1.2363
Decision B, Hypothetical Force	.562		
2) Expectancy ≠ .4			
Decision B, Decision A	.3519	47	7.123
Decision B, Hypothetical Force	.3390		
3) Expectancy ≠ .8			
Decision B, Decision A	.283	47	5.3648
Decision B, Hypothetical Force	.5668		

[a]The first entry is the mean squared multiple correlation coefficient. The other entries are the mean squared pairwise correlation coefficients.

Decision A = Course Grade Preference

Decision B = Indicated Effort (behavioral choice)

* $p < .01$

score between groups was not significantly different, the locus of control issue offered no insight into this particular data.

Summary

Table V is a summary of the t - tests used in the analysis of the valence and effort models. The data provide positive support for both of these models. In the case of the force model, however, the indication has a twofold meaning. It would appear that expectancy is used, but only in the sense of "some" or "zero", where any value greater then zero is equal to 1.

V. Summary and Conclusion

As part of Work and Motivation, Victor H. Vroom (1964) set forth two propositions directed at explaining or providing insight into human behavior. In general terms, these propositions were mathematical statements of two concepts. First, the attractiveness (valence) of a first level outcome is a function of the valence of second level outcomes and associated instrumentalities. Second, the motivational force directed at obtaining an outcome is a function of the valence of that outcome and the perceived probability (expectancy) that the outcome is attainable.

There have been numerous expansions and modifications to Vroom's model(s), as well as offerings of other distinct models. The majority of these models have undergone varied tests, but none have received consistent support or denial. Causation for this may lie in a failure to substantiate the worth of the basic propositions.

The entire thrust of the research presented in this thesis has been to examine the basic tenets of expectancy theory as hypothesized by Victor H. Vroom, Are the valence and force models accurate descriptors of human cognitions? Also, this research has examined the characteristics of the variable "expectancy". Is it a continuous variable, or is it dichotomous with values of 0 and one?

Almost any examination or test of a mathematical model requires data. The particular vehicle chosen to provide the data for this research was a policy capturing instrument designed to measure and quantify two variables, valence and hypothetical force. These variables were measured as "attractiveness" and "amount of additional effort to get an A", respectively. The other variables, instrumentality and expectancy, were manipulated through the design of the instrument. They were not measured, but stated as part of the exercise.

Great care was taken in constructing the policy capturing instrument, and this paid dividends. There is little doubt about the reliability of the exercise. The average R^2 for the policy equations was .8243, with a maximum of 1.000 and a minimum of .384. These figures point to the ability of the exercise to not only register individual differences, but to also quantify them.

The general conclusions to be drawn from the analysis of the data are not difficult to follow. The data were supportive of both Proposition 1 and Proposition 2. A caveat, however, is that the force model only holds true for a specific value of expectancy.

There are specific conclusions to be drawn from the analysis. First, the valence model is an accurate predictor of valence. The data indicate that in a cognitive sense individuals can and do assign different weights or

values to specified outcomes. The valence of these second level outcomes is in turn a determinant of the valence of that first level outcome perceived as leading to or from the second level outcomes. This then is the answer to the first research question. "Does the use of second level valence increase the accuracy of the prediction of first level valence?" Indeed it does.

Secondly, the data were supportive of Vroom's force model, but that support was weakened by the finding that expectancy does not appear to be a continuous variable.

Over three levels of expectancy, hypothetical force was a better predictor of effort than was Decision A alone. However, the isolation of each level provided a different result. The force model is a better predictor only in that instance when expectancy is equal to zero. The data indicate that when individuals are given or perceive an expectancy $\neq 0$, their decision is not influenced by that expectancy. When stated or perceived as zero, the reverse is true.

The examination of the nature of expectancy was an interesting affair. Three different tests all resulted in the same indication - expectancy is a dichotomous variable, with values zero and one. What must be asked, however, is what produces this result? Is the power of the zero value so strong that it overrides the effects of one? Or is the result due to the method of testing? In other words,

is expectancy really dichotomous, or does it act dichotomous when applied to the force model? This question is unresolved within the framework of this research.

As has been found by inumerable research efforts, the results are mixed. The data are supportive of the valence model, but supportive of the force model only in the special case where expectancy is equal to zero. Methodology may play a great part in this particular finding, but the results appear to be more believable than from previous methods.

Earlier, the test of a complex model without the prior proof of its components was likened to flight without the test of flight controls. This analogy may be true of the force model. If the true behavior or nature of the expectancy variable is unknown, how can one test a model of which it is part?

The final conclusion from all that has been said and done is that expectancy theory, as a whole, is still unproven and undenied. For the sample examined in this research, under the conditions of an academic environment, the valence model certainly holds great promise as a descriptor of individual perceptions. Also, the effort model is an apt descriptor of behavioral choice. However, the effort model requires a modification to expectancy for this to be true. What is necessary is that the behavioral characteristics of the variable expectancy be investigated further. If other methods

provide continuing support for the dichotomy of expectancy, then and only then can the model be refined or expanded, and its ultimate usefulness be realized.

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APPENDIX A

COURSE EFFORT SURVEY

COURSE EFFORT SURVEY

Please rank in order of importance the following factors which influence the amount of effort you put into an academic course. The most important will be ranked 1 and so on (8 factors).

FACTOR	RANK
Relation between the amount of effort and course grade	____
Relation between course material and future courses, AF job, and thesis work	____
Relation between subject matter and personally interesting subjects	____
Personality, attitude, and competence of the instructor (course climate)	____
Clarity of course objectives (is there a clear, meaningful purpose)	____
Amount of time available considering other courses	____
Personal achievement or satisfaction derived from effort	____
Grading scheme of the instructor	____

APPENDIX B

Form of survey for determination of outcomes associated with an A in an academic course

Please list below all of the outcomes you associate with receiving an A in an academic course. Please list both positive and negative outcomes if applicable.

APPENDIX C

A DECISION MAKING EXERCISE FOR AIR FORCE OFFICERS

A DECISION MAKING EXERCISE FOR
AIR FORCE OFFICERS

This decision making exercise is designed to investigate how individuals determine the amount of effort they will put forth in an academic course. The results of your participation, and that of others, will form the basis for the research leading to the completion of my masters thesis at the Air Force Institute of Technology. Your cooperation in this research will be greatly appreciated, for completion of my thesis hinges upon your assistance in completing and returning this exercise.

All information resulting from the completion of this questionnaire will be strictly confidential. If you would like to know the results, there is a space provided to so indicate.

The exercise contains three sections. Section I simply involves general information about yourself. Section II requires you to make several decisions concerning course effort. From this information, several hypothesis will be statistically tested concerning why individuals exert effort with respect to the course information provided. Section III contains a short list of questions which will provide information to be used to cross check the results of the decision making exercise.

After completing the entire exercise, please enclose it in the attached envelope and return it through the base distribution system.

Thank you for your participation.

Merl A. Morehouse

Merl A. Morehouse
Capt, USAF
Student/AFIT/ENS

PRIVACY STATEMENT

In accordance with paragraph 30, AFR 12-35, the following information is provided as required by the Privacy Act of 1974:

a. Authority

(1) 5 U.S.C. 301, Departmental Regulations; and/or

(2) 10 U.S.C. 80-12, Secretary of the Air Force, Powers and Duties, Delegation By.

b. Principal purposes. The decision making exercise is being conducted to collect information to be used in research aimed at illuminating and providing inputs to the solution of problems of interest to the Air Force and/or DOD.

c. Routine uses. The course effort data will be converted to information for research use toward management related problems. Results of the research, based on the data provided, will be included in a written masters thesis and may also be included in published articles, reports, and texts. Distribution of the results of the research, based on the exercise data, whether in written form or orally presented, will be unlimited.

d. Participation in this decision making exercise is entirely voluntary.

e. No adverse action of any kind may be taken against any individual who elects not to participate in any or all of this exercise.

SECTION I

General Information

Please circle the response that is most applicable or fill in the blank.

1. What is your current rank?

   A. 2nd Lt
   B. 1st Lt
   C. Captain
   D. Major
   E. Lt Col

2. What is your time in service?

   A. Less than 2 years
   B. 2 years but less than 4
   C. 4 years but less than 6
   D. 6 years but less than 8
   E. 8 years but less than 10
   F. 10 years but less than 12
   G. 12 years but less than 14
   H. 14 or more years

3. In what discipline did you earn your undergraduate degree?

   A. Engineering
   B. Management
   C. Business/Accounting
   D. Sciences
   E. Arts
   F. Other (Please specify) ____________

4. In what discipline are you earning your masters degree?

   A. Civel Eng
   B. Electrical Eng
   C. Systems Eng
   D. Systems Management
   E. Ops Research
   F. Aero Eng
   G. Eng Physics
   H. Nuclear Eng
   I. ASTRO Eng
   J. Computer Systems
   K. Other (Please specify) ____________

5. What is your age?

   A. 21 or less
   B. 22-25
   C. 26-30
   D. 31-35
   E. 36-40
   F. 41-45
   G. Over 45

6. What is your sex?

   A. Male
   B. Female

7. What is your marital status?

   A. Single
   B. Married
   C. Divorced
   D. Separated
   E. Widow/Widower

8. What is your cumulative Grade Point Average?

____

9. How many hours per week do you spend in academic efforts (including term papers, thesis work, and other efforts directly related to your academic environment, but excluding time spent in the classroom)?

____

10. If you would like to know how your decision making model compares with other AF officers, please indicate your student box number.

____

SECTION II

Exercise Description

The exercise consists of a number of hypothetical courses, with three outcomes associated with receiving an A in each course. The relationship between an A in the course and each of the factors can assume one of two values, VERY POSITIVE or ZERO. Below is a sample course using all of the factors. An explanation of the two ZERO relationships is provided -- special note should be taken of these explanations, for they do not appear in the format of the remaining courses.

SAMPLE COURSE

The relationship between an A in this course and ...

... an improved GPA (so much effort is required for this course you may receive lower grades in other courses) is .. ZERO

... the regard of your classmates is .... VERY POSITIVE

... a feeling of personal satisfaction (an A in this course is not a reflection of accomplishment) is .... ZERO

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
Very Unattractive										Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is high (probability = 80%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10
No additional effort to get an A										Great additiona effort to get an A

**NOTE: When making Decision B, you should assume that your present level of effort will earn you a "B" in the course.

Notice that for each course, you are asked to make two decisions. First (Decision A), you should judge the attractiveness of an A in the course, based upon the outcomes associated with the three key factors presented to you. Second (Decision B), you should decide how much additional effort you would exert in relation to the course, based upon all of the information provided to you.

Decision Making Exercise

The remainder of this section contains a decision making exercise. During the exercise, you should assume that you are presently enrolled in a number of academic courses. These courses do not differ from each other, except for the factors that are described to you in each instance. However, each course is different from all the others because of the information it contains. For this reason, please examine and consider each course carefully, and make your decisions based upon the information it contains.

Work briskly, but do not hurry. There are no "correct" or "incorrect" decisions for these courses, so express your true feelings and intentions. You should attempt to finish the complete exercise in a single sitting, which should take about 20 minutes.

Thank you for your cooperation in participating in this study.

COURSE # 1

The relationship between an A in this course and ...

... an improved Grade Point Average is .... ZERO

... the regard of your classmates is .... VERY POSITIVE

... a feeling of personal satisfaction is .... VERY POSITIVE

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
Very Unattractive										Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is zero (probability = 0%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10
No additional effort to get an A										Great additional effort to get an A

COURSE # 2

The relationship between an A in this course and ...

... an improved Grade Point Average is .... VERY POSITIVE

... the regard of your classmates is .... VERY POSITIVE

... a feeling of personal satisfaction is .... VERY POSITIVE

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
Very Unattractive										Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is moderate (probability = 40%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10
No additional effort to get an A										Great additional effort to get an A

COURSE # 3

The relationship between an A in this course and ...

... an improved Grade Point Average is .... ZERO

... the regard of your classmates is .... VERY POSITIVE

... a feeling of personal satisfaction is .... VERY POSITIVE

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
Very Unattractive										Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is high (probability = 80%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10
No additional effort to get an A										Great additional effort to get an A

COURSE # 4

The relationship between an A in this course and ...

... an improved Grade Point Average is .... VERY POSITIVE

... the regard of your classmates is .... VERY POSITIVE

... a feeling of personal satisfaction is .... ZERO

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
Very Unattractive										Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is high (probability = 80%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10
No additional effort to get an A										Great additional effort to get an A

COURSE # 5

The relationship between an A in this course and ...

... an improved Grade Point Average is .... VERY POSITIVE

... the regard of your classmates is .... ZERO

... a feeling of personal satisfaction is .... VERY POSITIVE

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5

Very Unattractive — Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is high (probability = 80%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

No additional effort to get an A — Great additional effort to get an A

COURSE # 6

The relationship between an A in this course and ...

... an improved Grade Point Average is .... ZERO

... the regard of your classmates is .... ZERO

... a feeling of personal satisfaction is .... VERY POSITIVE

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5

Very Unattractive — Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is high (probability = 80%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

No additional effort to get an A — Great additional effort to get an A

COURSE # 7

The relationship between an A in this course ...

... an improved Grade Point Average is .... ZERO

... the regard of your classmates is .... ZERO

... a feeling of personal satisfaction is .... VERY POSITIVE

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5

Very Unattractive — Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is zero (probability = 0%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

No additional effort to get an A — Great additional effort to get an A

COURSE # 8

The relationship between an A in this course and ...

... an improved Grade Point Average is .... VERY POSITIVE

... the regard of your classmates is .... ZERO

... a feeling of personal satisfaction is .... ZERO

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5

Very Unattractive — Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is moderate (probability = 40%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

No additional effort to get an A — Great additional effort to get an A

COURSE # 9

The relationship between an A in this course and ...

... an improved Grade Point Average is .... VERY POSITIVE

... the regard of your classmates is .... ZERO

... a feeling of personal satisfaction is .... VERY POSITIVE

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5

Very Unattractive — Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is zero (probability = 0%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

No additional effort to get an A — Great additional effort to get an A

COURSE # 10

The relationship between an A in this course and ...

... an improved Grade Point Average is .... VERY POSITIVE

... the regard of your classmates is .... VERY POSITIVE

... a feeling of personal satisfaction is .... ZERO

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5

Very Unattractive — Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is zero (probability = 0%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

No additional effort to get an A — Great additional effort to get an A

COURSE # 11

The relationship between an A in this course and ...

... an improved Grade Point Average is .... ZERO

... the regard of your classmates is .... ZERO

... a feeling of personal satisfaction is .... ZERO

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5

Very Unattractive — Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is high (probability = 80%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10

No additional effort to get an A — Great additional effort to get an A

COURSE # 12

The relationship between an A in this course and ...

... an improved Grade Point Average is .... VERY POSITIVE

... the regard of your classmates is .... VERY POSITIVE

... a feeling of personal satisfaction is .... VERY POSITIVE

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5

Very Unattractive — Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is zero (probability = 0%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10

No additional effort to get an A — Great additional effort to get an A

COURSE # 13

The relationship between an A in this course and ...

... an improved Grade Point Average is .... ZERO

... the regard of your classmates is .... VERY POSITIVE

... a feeling of personal satisfaction is .... ZERO

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5

Very Unattractive — Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is high (probability = 80%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

No additional effort to get an A — Great Additional effort to get an A

COURSE # 12

The relationship between an A in this course and ...

... an improved Grade Point Average is .... VERY POSITIVE

... the regard of your classmates is .... VERY POSITIVE

... a feeling of personal satisfaction is .... ZERO

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5

Very Unattractive — Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is moderate (probability = 40%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

No additional effort to get an A — Great additional effort to get an A

COURSE # 15

The relationship between an A in this course and ...

... an improved Grade Point Average is .... ZERO

... the regard of your classmates is .... ZERO

... a feeling of personal satisfaction is .... ZERO

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5

Very Unattractive — Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is moderate (probability = 40%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

No additional effort to get an A — Great additional effort to get an A

COURSE # 16

The relationship between an A in this course and ...

... an improved Grade Point Average is .... VERY POSITIVE

... the regard of your classmates is .... ZERO

... a feeling of personal satisfaction is .... VERY POSITIVE

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5

Very Unattractive — Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is moderate (probability = 40%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

No additional effort to get an A — Great additional effort to get an A

COURSE # 17

The relationship between an A in this course and ...

... an improved Grade Point Average is .... ZERO

... the regard of your classmates is .... VERY POSITIVE

... a feeling of personal satisfaction is .... ZERO

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5

Very Unattractive — Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is zero (probability = 0%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

No additional effort to get an A — Great additiona effort to get an A

COURSE # 18

The relationship between an A in this course and ...

... an improved Grade Point Average is .... ZERO

... the regard of your classmates is .... ZERO

... a feeling of personal satisfaction is .... VERY POSITIVE

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5

Very Unattractive — Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is moderate (probability = 40%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

No additional effort to get an A — Great additiona effort to get an A

AD-A076 201 AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOO--ETC F/G 5/10
EXPECTANCY THEORY AND POLICY CAPTURING: A PREDICTIVE MODEL OF S--ETC(U)
SEP 79 M A MOREHOUSE
UNCLASSIFIED AFIT/GSM/SM/79S-11 NL

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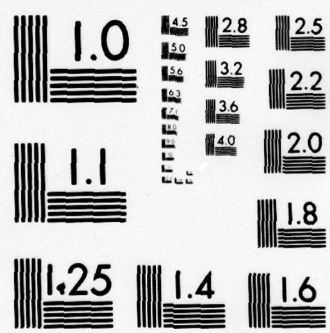

MICROCOPY RESOLUTION TEST CHART

COURSE # 19

The relationship between an A in this course and ...

... an improved Grade Point Average is .... VERY POSITIVE

... the regard of your classmates is .... ZERO

... a feeling of personal satisfaction is .... ZERO

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
Very Unattractive										Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is high (probability = 80%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10
No additional effort to get an A										Great additional effort to get an A

COURSE # 20

The relationship between an A in this course and ...

... an improved Grade Point Average is .... ZERO

... the regard of your classmates is .... VERY POSITIVE

... a feeling of personal satisfaction is .... ZERO

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
Very Unattractive										Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is moderate (probability = 40%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10
No additional effort to get an A										Great additional effort to get an A

COURSE # 21

The relationship between an A in this course and ...

... an improved Grade Point Average is .... ZERO

... the regard of your classmates is .... VERY POSITIVE

... a feeling of personal satisfaction is .... VERY POSITIVE

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
Very Unattractive										Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is moderate (probability = 40%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10
No additional effort to get an A										Great additional effort to get an A

COURSE # 22

The relationship between an A in this course and ...

... an improved Grade Point Average is .... VERY POSITIVE

... the regard of your classmates is .... ZERO

... a feeling of personal satisfaction is .... ZERO

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
Very Unattractive										Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is zero (probability = 0%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10
No additional effort to get an A										Great additional effort to get an A

COURSE # 23

The relationship between an A in this course and ...

... an improved Grade Point Average is .... VERY POSITIVE

... the regard of your classmates is .... VERY POSITIVE

... a feeling of personal satisfaction is .... VERY POSITIVE

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5

Very Unattractive — Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is high (probability = 80%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

No additional effort to get an A — Great additional effort to get an A

COURSE # 24

The relationship between an A in this course and ...

... an improved Grade Point Average is .... ZERO

... the regard of your classmates is .... ZERO

... a feeling of personal satisfaction is .... ZERO

Decision A. With the factors and outcomes shown above in mind, indicate the attractiveness of an A in this course:

-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5

Very Unattractive — Very Attractive

Further Information. If you exert a great amount of additional effort, the likelihood you can get an A is zero (probability = 0%).

Decision B. With the attractiveness and likelihood information above in mind, indicate how much additional effort you would exert in this course to get an A.

0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

No additional effort to get an A — Great additional effort to get an A

SECTION III

The answers to the following questions will provide information which will be used to cross check the results of the decision making exercise.

INSTRUCTIONS: Each item consists of a pair of alternatives lettered a or b. Circle the letter which corresponds to the statement which you more strongly believe to be the case as far as you're concerned. Try to respond to each item independently when making your choice. There are no right or wrong answers: this is a measure of personal belief.

1. a. The idea that teachers are unfair to students is nonsense.
   b. Most students don't realize the extent to which their grades are influenced by accidental happening.

2. a. In the case of the well prepared student there is rarely if ever such a thing as an unfair test.
   b. Many times exam questions tend to be so unrelated to course work that studying is really useless.

3. a. Sometimes I can't understand how teachers arrive at the grades they give.
   b. There is a direct connection between how hard I study and the grades I get.

The final item is not a question. Please indicate what relative weight you feel you placed on each outcome associated with the hypothetical courses. Do this by distributing 100 points among the three outcomes.

...an improved Grade Point Average ______
...regard of classmates ______
...feeling of personal satisfaction ______
Total 100

APPENDIX D

PAIRED SAMPLE T - TEST

PAIRED SAMPLE T - TEST

For a paired sample t - test, a new random variable is formed which is equal to the difference in the paired observations.

The null hypothesis is that the mean difference is equal to zero ($\mu_d = 0$).

the t statistic is:

$$t = \frac{\bar{d} - \mu_d}{s_{\bar{d}}/\sqrt{n}}$$

(Adapted from Nie, et al., 1975, p. 270)

APPENDIX E

Sample Population Classification by
Category of Demographic Variable

Sample Population Classification by Category of Demographic Variable

Demographic and Response Group	Absolute Frequency	Percentage
Grade		
2nd Lt	14	28
1st Lt	3	6
Capt	32	64
Major	1	2
TIS		
Less than 2 years	13	26
2 years to 4 years	2	4
4 years to 6 years	13	26
6 years to 8 years	7	14
8 years to 10 years	5	10
10 years to 12 years	4	8
12 years to 14 years	3	6
14 or more years	3	6
BA/BS Degree		
Engineering	39	78
Sciences	9	18
Other	2	4
MS Degree		
Electrical Eng	19	38
Systems Eng	2	4
Computer Systems	6	12
Aero Eng	8	16
Eng Physics	7	14
Nuclear Eng	1	2
Astro Eng	5	10
Other	2	4

Appendix E (Continued)

Demographic and Response Group	Absolute Frequency	Percentage
Age		
22-25	14	28
26-30	25	50
31-35	9	18
36-40	2	4
Sex		
Male	49	98
Female	1	2
Marital Status		
Single	10	20
Married	39	78
Divorced	1	2

APPENDIX F

Regression Results and Subjective Weights

Regression Results and
Subjective Weights

B_1 = Beta weight associated with "GPA"

B_2 = Beta weight associated with "regard of classmates"

B_3 = Beta weight associated with "personal satisfaction"

W_i = Relative weight associated with each of the above outcomes

SW = Subjective Weights

Student	R^2	B_1	B_2	B_3	W_1	W_2	W_3
1	.895	.221	.063	.918	.055	.004	.941
SW					.30	.10	.60
2	1.000	.667	.333	.667	.444	.111	.444
SW					.40	.20	.40
3	.904	.757	-.195	.541	.634	.042	.324
SW					.90	0	.10
4	.859	.535	.107	.749	.333	.013	.653
SW					.35	.05	.60
5	.907	.560	.065	.768	.345	.005	.650
SW					.40	0	.60
6	.747	.794	.242	.242	.844	.078	.078
SW					.95	.03	.02
7	1.00	0	0	1.0	0	0	1.0
SW					0	.2	.98
8	.786	.700	.280	.467	.623	.100	.277
SW					.50	.10	.40
9	.656	.707	.177	.354	.762	.048	.190
SW					.60	.20	.20
10	.783	.292	.241	.800	.109	.074	.817
SW					.15	.05	.80
11	.860	.920	.084	-.084	.984	.008	.008
SW					1.00	0	0

APPENDIX F (Continued)

Student	R^2	B_1	B_2	B_3	W_1	W_2	W_3
12	.749	.530	.434	.530	.375	.251	.375
SW					.50	.20	.30
13	.804	.788	.347	.252	.772	.149	.079
SW					.75	.20	.05
14	.923	.059	.356	.890	.004	.137	.859
SW					.10	.30	.60
15	.384	.320	.123	.517	.266	.039	.694
SW					MISSING	DATA	
16	.657	.516	.141	.609	.405	.030	.565
SW					.475	.05	.475
17	.796	.819	-.079	.344	.844	.008	.148
SW					.60	0	.40
18	.913	.770	.400	.400	.649	.175	.175
SW					.50	.30	.20
19	1.00	.667	.333	.667	.444	.111	.444
SW					.40	.20	.40
20	.990	.707	.319	.624	.505	.103	.393
SW					.40	.20	.40
21	.762	.315	.466	.668	.130	.285	.585
SW					.20	.45	.35
22	.933	.247	.157	.921	.065	.026	.908
SW					.15	.15	.70
23	.685	.669	.251	.418	.653	.092	.255
SW					.50	.10	.40
24	1.00	0	0	1.00	0	0	1.00
SW					0	0	1.00
25	.830	.314	.314	.796	.118	.118	.763
SW					.15	.35	.50
26	.802	.525	.297	.662	.344	.110	.546
SW					.30	.30	.40
27	.589	.606	.223	.415	.623	.085	.292
SW					.60	.10	.30

APPENDIX F (Continued)

Student	R^2	B_1	B_2	B_3	W_1	W_2	W_3
28	.768	.600	-.218	.600	.469	.062	.469
SW					.50	.10	.40
29	.893	.594	.224	.700	.395	.056	.548
SW					.45	.10	.45
30	.517	-.070	-.348	.626	.009	.234	.757
SW					.30	.20	.50
31	.917	-.483	.097	.821	.254	.010	.735
SW					.10	.30	.60
32	.900	.415	.090	.848	.191	.009	.799
SW					.40	.10	.50
33	.973	.100	.100	.976	.010	.010	.980
SW					.10	.10	.80
34	.877	.540	.141	.752	.333	.023	.644
SW					.50	.10	.40
35	.875	.791	.158	.474	.714	.029	.257
SW					.60	.10	.30
36	.792	.674	.411	.411	.574	.213	.213
SW					.40	.20	.40
37	.873	.674	.0	.674	.480	.0	.520
SW					.50	.10	.40
38	.786	.759	.307	.339	.734	.120	.146
SW					.60	.0	.40
39	.698	.698	.175	.424	.699	.044	.258
SW					.70	.10	.20
40	.855	-.023	.386	.840	.001	.174	.825
SW					0	.40	.60
41	.878	.734	.412	.412	.614	.193	.193
SW					.60	.10	.30
42	.793	.882	.112	.048	.981	.016	.003
SW					.60	.10	.30
43	.877	.775	-.025	.525	.685	.001	.314
SW					.70	.0	.30

APPENDIX F (Continued)

Student	R^2	B_1	B_2	B_3	W_1	W_2	W_3
44	.841	.779	.182	.448	.722	.040	.238
SW					.70	.0	.30
45	.704	0	.411	.731	0	.240	.760
SW					.10	.30	.60
46	.559	.664	.285	.190	.790	.145	.065
SW					.40	.30	.30
47	.900	.507	.254	.761	.286	.071	.643
SW					.35	.20	.45
48	.889	.667	0	.667	.500	0	.500
SW					.35	0	.65
49	.909	.455	.290	.786	.228	.092	.680
SW					.35	.10	.55
50	.927	.953	.124	.062	.979	.017	.004
SW					.70	.05	.25
***	.8243	.513	.181	.585	.418	.132	.429
					.441	.080	.479

*** Averages

Shrunken R^2 (Cohen and Cohen, 1975, p. 106) = .8087

APPENDIX G

Statistical Test of the Valence Model

STATISTICAL TEST OF THE VALENCE MODEL

R^2 = R^2 of regression equation for Decision A

r^2 = correlation of unweighted sum of instrumentalities (ΣI) with Decision A

Student	R^2	r^2
1	.895	.4818
2	1.000	.9260
3	.904	.4062
4	.859	.6451
5	.907	.6466
6	.747	.5439
7	1.000	.3334
8	.786	.6979
9	.656	.5104
10	.783	.5921
11	.860	.2821
12	.749	.7432
13	.804	.6408
14	.923	.5681
15	.384	.3069
16	.657	.5341
17	.796	.3916
18	.913	.8217
19	1.000	.9260
20	.990	.9065

APPENDIX G (Continued)

Student	R^2	r^2
21	.762	.6994
22	.933	.5851
23	.685	.5968
24	1.000	.3334
25	.830	.6750
26	.802	.7339
27	.589	.5158
28	.768	.3214
29	.893	.7686
30	.517	.0145
31	.917	.0629
32	.900	.6106
33	.973	.4606
34	.877	.6848
35	.875	.6750
36	.792	.7455
37	.873	.5817
38	.786	.6585
39	.698	.5609
40	.855	.4826
41	.878	.8089
42	.793	.3623
43	.877	.5423
44	.841	.6618

APPENDIX G (Continued)

Student	R^2	r^2
45	.704	.4349
46	.559	.4329
47	.900	.7714
48	.889	.5926
49	.909	.7815
50	.927	.4326
AVG	.8243	.5698

Hypothesis and Statistical Test

$\alpha = .01$

$n = 50$

$t_{\alpha/2,\ n-1} = t_{.005,\ 49} = 2.576$

μ_1 = mean R^2 = .8243

μ_2 = mean r^2 = .5698

$\bar{d}$ = mean difference = .2454

$S_{\bar{d}} = .19467$

Hypothesis: An unweighted sum of the instrumentalities is as good a predictor of attractiveness as is a weighted sum of instrumentalities (regression equation = ΣIV).

$H_o: \mu_d = 0$

$H_a: \mu_1 \neq \mu_2$

$$t = \frac{\bar{d} - \mu d}{S_{d/\sqrt{n}}} = \frac{.2545 - 0}{.19467/7.0711} = 9.254$$ Reject H_o

APPENDIX H

Statistical Test of the Force Model

STATISTICAL TEST OF THE FORCE MODEL

r_1^2 = square of correlation between Decision A and Decision B

r_2^2 = square of correlation between hypothetical force (E x Decision A) and Decision B

Student	r_1^2	r_2^2
1	.840	.464
2	.271	.353
3	.146	.796
4	.453	.585
5	.087	.282
6	.130	.794
7	---	---
8	.172	.562
9	.003	.393
10	.553	.240
11	.480	.652
12	.210	.855
13	.138	.328
14	.636	.452
15	.918	.677
16	.256	.710
17	.092	.653
18	,192	.865
19	.243	.389
20	.531	.645

APPENDIX H (Continued)

Student	r_1^2	r_2^2
21	.135	.553
22	.444	.810
23	.406	.606
24	---	---
25	.247	.397
26	.462	.547
27	.147	.586
28	.198	.424
29	.282	.520
30	.000	.838
31	.670	.406
32	.480	.883
33	.069	.721
34	.293	.555
35	.307	.706
36	.110	.269
37	.118	.411
38	.020	.068
39	.141	.152
40	.363	.512
41	.274	.692
42	.475	.611
43	.190	.601
44	.124	.316
45	.357	.715

APPENDIX H (Continued)

Student	r_1^2	r_2^2
46	.021	.824
47	.061	.678
48	.601	.634
49	.331	.734
50	.009	.002
AVG	.285	.551

Hypothesis and Statistical Test

$n = 48$

$\alpha = .01$

$t_{\alpha/2,\, n-1} = t_{.005,\, 47} = 2.576$

$\mu_1 = \text{mean } r_1^2 = .285$

$\mu_2 = \text{mean } r_2^2 = .551$

$\bar{d} = \text{mean difference} = \mu_2 - \mu_1 = .266$

Hypothesis: Decision A is as good a predictor of effort as is hypothetical force (Decision A x E)

$H_o: \mu_d = 0$

$H_a: \mu_2 \neq \mu_1$

$$t = \frac{\bar{d} - \mu_d}{S_d/\sqrt{n}} = \frac{.266 - 0}{.283/6.928} = 6.5196$$

REJECT H_o

This provides support for Vroom's force model (ΣEV).

APPENDIX I

Statistical Test of Expectancy As A Dichotomous Variable

STATISTICAL TEST OF EXPECTANCY AS A DICHOTOMOUS VARIABLE

r_1^2 = square of correlation between Decision A and Decision B

r_2^2 = square of correlation between hypothetical force (E x Decision A) and Decision B

	Expectancy ≠ 0		Expectancy ≠ .4		Expectancy ≠ .8	
Student	r_1^2	r_2^2	r_1^2	r_2^2	r_1^2	r_2^2
1	.832	.738	.857	.407	.880	.378
2	.510	.104	.399	.852	.192	.837
3	.575	.734	.112	.856	.052	.794
4	.530	.762	.458	.582	.578	.373
5	.260	.389	.081	.323	.059	.203
6	.465	.622	.129	.861	.030	.792
7	---	---	---	---	---	---
8	.283	.506	.123	.566	.411	.376
9	.043	.128	.007	.491	.042	.381
10	.584	.497	.558	.171	.561	.184
11	.984	.912	.297	.604	.274	.656
12	.828	.741	.102	1.000	.119	.876
13	.281	.338	.051	.265	.320	.616
14	.658	.557	.616	.465	.686	.382
15	.878	.810	.947	.721	.897	.542
16	.814	.537	.171	.826	.252	.870

APPENDIX I (Continued)

Student	Expectancy ≠ 0 r_1^2	Expectancy ≠ 0 r_2^2	Expectancy ≠ .4 r_1^2	Expectancy ≠ .4 r_2^2	Expectancy ≠ .8 r_1^2	Expectancy ≠ .8 r_2^2
17	.624	.523	.017	.712	.080	.759
18	.794	.789	.111	.960	.127	.945
19	.792	.843	.175	.350	.118	.236
20	.745	.837	.487	.607	.623	.533
21	.867	.832	.054	.555	.063	.514
22	.901	.815	.345	.872	.354	.780
23	.712	.331	.229	.805	.393	.955
24	---	---	---	---	---	---
25	.476	.421	.192	.416	.130	.444
26	.618	.674	.370	.578	.517	.320
27	.259	.370	.088	.604	.176	.753
28	.177	.391	.230	.452	.268	.263
29	.489	.601	.251	.542	.225	.402
30	.001	.500	.007	.945	.011	.740
31	.679	.581	.722	.329	.716	.403
32	.876	.931	.416	.899	.366	.757
33	.211	.587	.039	.752	.135	.918
34	.585	.650	.199	.521	.309	.588
35	.674	.569	.190	.806	.212	.805
36	---	---	---	---	---	---
37	.393	.527	.091	.423	.053	.314
38	.059	.080	.012	.077	.081	.230
39	.213	.175	.085	.108	.224	.423

APPENDIX I (Continued)

Student	Expectancy ≠ 0 r_1^2	Expectancy ≠ 0 r_2^2	Expectancy ≠ .4 r_1^2	Expectancy ≠ .4 r_2^2	Expectancy ≠ .8 r_1^2	Expectancy ≠ .8 r_2^2
40	.839	.790	.250	.534	.205	.511
41	.618	.676	.181	.677	.190	.781
42	.602	.610	.392	.590	.590	.741
43	.536	.315	.152	.778	.094	.854
44	.155	.288	.171	.378	.089	.117
45	.755	.776	.214	.716	.406	.605
46	.027	.602	.001	.837	.264	.826
47	.142	.489	.039	.716	.078	.762
48	.738	.733	.592	.679	.530	.468
49	.672	.729	.235	.796	.269	.632
50	.002	.001	.021	.005	.054	.010
AVG	.528	.562	.244	.5959	.283	.5668

Expectancy ≠ 0	Expectancy ≠ .4	Expectancy ≠ .8
$\bar{d}$ = .034	$\bar{d}$ = .3519	$\bar{d}$ = .2838
$s_{\bar{d}}$ = .1886	$s_{\bar{d}}$ = .3390	$s_{\bar{d}}$ = .3627

Hypothesis and Statistical Test

There are three paired samples above, one for each excluded level of expectancy. The null hypothesis and statistical test is identical for each case according to the following:

Hypothesis: Decision A is as good a predictor of Decision B as is hypothetical force (E x Decision A)

APPENDIX I (Continued)

$$H_o: \mu_d = 0$$

$$H_a: \mu_2 \neq \mu_1$$

$$t = \frac{\bar{d} - \mu}{s_d/\sqrt{n}}$$

Using the data above:

1) For Expectancy $\neq$ 0, t = 1.2363

   Fail to Reject the null

2) For Expectancy $\neq$ .4, t = 7.123

   Reject the null

3) For Expectancy $\neq$ .8, t = 5.3648

   Reject the null

APPENDIX J

Test # 2 of Expectancy as a Dichotomous Variable

TEST # 2 OF EXPECTANCY AS

A DICHOTOMOUS VARIABLE

$d = r_2^2 - r_1^2$, r_1^2 and r_2^2 as defined in Appendix I

The respondents listed below exhibited variance (Decision B > 0) for at least one Decision B where the probability of receiving an A was zero.

$d = r_2^2 - r_1^2$, r_1^2 and r_2^2 as defined and listed in Appendix I.

	Expectancy $\neq$ 0	Expectancy $\neq$ .4	Expectancy $\neq$ .8
Student	d	d	d
1	-.094	-.450	-.502
2	-.406	.453	.645
4	.232	.124	-.205
8	.223	.443	-.035
9	.085	.484	.339
10	-.087	-.387	-.377
14	-.101	-.151	-.304
15	-.068	-.226	-.355
16	-.277	.655	.618
17	-.101	.695	.679
20	.092	.120	-.090
22	-.086	.527	.426
26	.056	.208	-.197
28	.214	.222	-.005

APPENDIX J (Continued)

Student	Expectancy ≠ 0 d	Expectancy ≠ .4 d	Expectancy ≠ .8 d
29	.112	.291	.177
31	-.098	-.393	-.313
32	.055	.483	.391
34	.065	.322	.279
39	-.038	.023	.199
42	.008	.198	.151
44	.133	.207	.028
45	.021	.502	.199
46	.575	.836	.562
48	-.005	.087	-.062
49	.057	.561	.363
50	-.001	-.016	-.044
AVG	.02176	.2237	.0987
s_d	.1821	.3466	.3418

Hypothesis and Statistical Test

$n = 26$

$t_{\alpha/2,\, n-1} = t_{.005,\, 25} = 2.787$

Each paired sample as defined by an <u>excluded</u> level of expectancy was examined through the hypothesis and statistical test as follows:

Hypothesis: Decision A is as good a predictor of Decision B as in hypothetical force (E x Decision A).

APPENDIX J (Continued)

H_o: $\mu_d = 0$

H_a $\mu_2 \neq \mu_1$

$$t = \frac{\bar{d} - \mu_d}{s_d/\sqrt{n}}$$

For: 1) Expectancy $\neq$ 0, t = .6093

Fail to reject the null

2) Expectancy $\neq$ .4, t = 3.294

Reject the null

3) Expectancy $\neq$ .8, t = 1.473

Fail to reject the null

APPENDIX K

Test #3 of Expectancy as a Dichotomous Variable

TEST #3 OF EXPECTANCY AS

A DICHOTOMOUS VARIABLE

r_1^2 = square of correlation between Decision A and Decision B

r_2^2 = square of correlation between hypothetical force (E x Decision A) and Decision B

Note: This test was made using two levels of expectancy, 0 and 1. This was done by setting .4 and .8 equal to 1.

Student	r_2^2	r_1^2
1	.520	.840
2	.694	.271
3	.745	.146
4	.501	.453
5	.202	.087
6	.723	.130
7	---	---
8	.426	.172
9	.339	.003
10	.277	.553
11	.723	.480
12	.912	.210
13	.258	.130
14	.477	.636

APPENDIX K (Continued)

Student	r_2^2	r_1^2
15	.704	.918
16	.861	.256
17	.740	.092
18	.912	.192
19	.365	.243
20	.573	.531
21	.557	.135
22	.863	.444
23	.850	.406
24	---	---
25	.440	.247
26	.500	.462
27	.539	.147
28	.348	.198
29	.437	.282
30	.709	.000
31	.473	.670
32	.852	.480
33	.480	.069
34	.510	.293
35	.764	.307
36	.260	.110
37	.338	.118
38	.058	.020

APPENDIX K (Continued)

Student	r_2^2	r_1^2
39	.182	.141
40	.596	.363
41	.653	.274
42	.624	.475
43	.759	.190
44	.227	.124
45	.706	.357
46	.560	.021
47	.578	.061
48	.640	.601
49	.707	.331
50	.001	.009
AVG	.5450	.2851

Hypothesis and Statistical Test

$\alpha = .01$

$n = 48$

$t_{\alpha/2,\ n-1} = t_{.005,\ 47} = 2.576$

Hypothesis: Decision A is as good a predictor of effort as is hypothetical force (E x Decision A).

APPENDIX K (Continued)

H_o: $\mu_d = 0$

H_A: $\mu_2 \neq \mu_1$

$$t = \frac{\bar{d} - \mu_d}{s/\sqrt{n}} = \frac{.260 - 0}{.266/\sqrt{48}} = \frac{.260}{.0384} = \underline{\underline{6.7708}}$$

Reject the null

APPENDIX L

Test for Difference in Mean Rotter Score

TEST FOR DIFFERENCE IN MEAN ROTTER SCORE

Decision B = 0 for all cases where expectancy = 0		Decision B ≠ 0 for at least one case where expectancy = 0	
Student	Rotter Score	Student	Rotter Score
3	0	1	3
5	3	2	2
6	3	4	2
7	2	8	2
11	1	9	1
12	2	10	3
13	0	14	3
18	2	15	3
19	3	16	3
21	2	17	3
23	3	20	1
24	2	22	1
25	0	26	2
27	1	28	1
30	3	29	2
33	2	31	2
35	3	32	2
36	3	34	3
37	3	39	2
38	0	42	1

APPENDIX L (Continued)

Student	Rotter Score
40	3
41	0
43	0
47	0

$\mu_1 = 1.7083$

$s_1 = 1.2676$

$n_1 = 24$

Student	Rotter Score
44	3
45	2
46	3
48	1
49	1
50	0

$\mu_2 = 2.00$

$s_2 = .8944$

$n_2 = 26$

Hypothesis and Statistical Test

The statistical test is for a difference in means (Nie, et al.,1975,p269), with the t statistic

$$t = \frac{\mu_2 - \mu_1}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

where $$s = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

Hypothesis: Students with variance in indicated effort will have a higher Rotter score.

$H_0: \mu_2 = \mu_1$

$H_A: \mu_2 > \mu_1$

Substituting into the above equations yields:

$t = .965894$

Fail to reject the null

APPENDIX M

Calculation of Reliability for Rotter Scale

CALCULATION OF RELIABILITY

FOR ROTTER SCALE

Coefficient alpha (Nunnally, 1978, p. 214)

$$r_{kk} = \frac{k}{k-1}\left(1 - \frac{\Sigma s_i^2}{s_y^2}\right)$$

where k = # of items

s_i^2 = variance of each item

s_y^2 = variance of the sum

from the Factor Analysis and Frequency Distribution

$s_1 = .4986$

$s_2 = .4492$

$s_3 = .4901$

$s_y = 1.088$

therefore

$$r_{kk} = \frac{3}{2}\left(1 - \frac{.6904}{1.184}\right)$$

$$= 1.5\ (1 - .5828)$$

$$r_{kk} = \underline{\underline{.6258}}$$

VITA

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